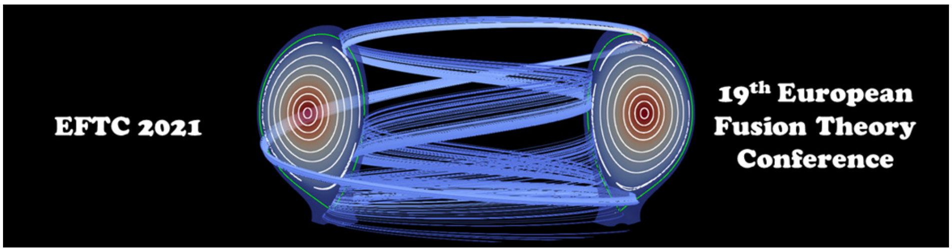

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Finite orbit width effects on neoclassical transport in large aspect ratio tokamaks

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The pedestal, and transport barriers in general, play an important role in tokamak performance and thus it is desirable to find a comprehensive model for these regions. In transport barriers, the applicability of standard neoclassical theory is limited because of sharp gradients of temperature, density, and radial electric field. We have developed a new neoclassical approach that sets the scale length in transport barriers to be the poloidal gyroradius. This ordering implies that the poloidal component of the E×B-drift becomes of the order of the thermal velocity. Using large aspect ratio and low collisionality expansions, we define a new set of variables based on conserved quantities, which simplifies the drift kinetic equation whilst keeping finite orbit width effects. Previous work, which accounted for strong gradients in density and electric field, is extended by allowing the temperature gradient to have the same scale length as the density gradient, and by including a poloidally varying part in the electric potential, which modifies the trapping condition for particles in the transport barrier. Studying contributions from both passing particles and trapped particles in the banana regime, we find that the resulting transport equations of particles, parallel momentum and energy are dominated by trapped particles. The poloidally varying part of the electric potential does not only contribute to transport but plays an important role in trapping particles as it grows across the transport barrier. We manage to reproduce profiles of density and temperature that are similar to those measured in real devices and find that it is necessary to choose a finite particle flux as well as a non-zero parallel momentum input to do so.

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